# EVALUATION OF ASYMPTOMATIC FAMILY MEMBERS FOR LEPTOSPIROSIS IN PATIENTS WITH SYMPTOMATIC LEPTOSPIROSIS

*Dissertation submitted to*

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*In partial fulfillment of the regulations*

*for the award of the degree of*

## M.D. BRANCH - I

## GENERAL MEDICINE


**GOVT. STANLEY MEDICAL COLLEGE & HOSPITAL**
**THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY**
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# CERTIFICATE

This is to certify that the dissertation titled **"EVALUATION OF ASYMPTOMATIC FAMILY MEMBERS FOR LEPTOSPIROSIS IN PATIENTS WITH SYMPTOMATIC LEPTOSPIROSIS"** is the bonafide original work of **Dr. J. BHARATH,** in partial fulfillment of the requirements for M.D. Branch – I (General Medicine) Examination of the Tamilnadu DR. M.G.R Medical University to be held in MARCH 2009. The Period of study was from January 2007 to June 2008.


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# DECLARATION

I, **DR. J. BHARATH,** solemnly declare that dissertation titled **"Evaluation of Asymptomatic Family Members for Leptospirosis in patients with symptomatic Leptospirosis"** is a bonafide work done by me at Government Stanley Medical College and Hospital during January 2007 to June 2008 under the guidance and supervision of my unit chief **Prof. S.Ramasamy, M.D.,** Professor of Therapeutics, Government Stanley Medical College and Hospital, Chennai.

This dissertation is submitted to Tamilnadu Dr. M.G.R Medical University, towards partial fulfillment of requirement for the award of **M.D. Degree (Branch – I) in General Medicine – March 2009.**

Place : Chennai **(DR. J. BHARATH)**

Date :

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# CONTENTS

# INTRODUCTION

Leptospirosis has long been considered a rare zoonotic disease in India with only sporadic cases being reported. Since 1980, the disease has been reported from various States especially during monsoon months.

This disease is endemic in Tamil Nadu and few other States. In Tamil Nadu, more number of cases are reported from Chennai, especially North Chennai. Still the disease is underdiagnosed and underreported in other parts of Tamil Nadu.

Increasing availability of laboratory tests and very clear clinical criteria such as modified Faine's criteria help to diagnose the disease easily. Due to this diagnostic ease and availability of lab tests, this study has been undertaken to study the Asymptomatic Leptospiral infection among family members and close contacts of the Leptospirosis patients who are living in a same environment, and also to analyse the environmental risk factors associated with the symptomatic and asymptomatic leptospiral infection.

## AIMS OF THE STUDY

- To study the clinical profile of symptomatic leptospirosis and to evaluate the asymptomatic family members of confirmed leptospirosis patients with diagnostic test for leptospiral infection

- To analyze the epidemiological risk factors associated with the leptospiral infection.

# REVIEW OF THE LITERATURE

Leptospirosis is a disease characterized by broad spectrum of clinical findings caused by a single family of organisms of which there are multiple serogroups and serotypes. The genus leptospira comprises the pathogenic leptospires (L. interrogans) and the saprophytic leptospires (L. biflexa). L. interrogans comprise 23 serogroups and over 200 serotypes. This infection and disease reflects the sociological history of the nation, movement of its population from rural to an urban environment, the occupations of its inhabitants and the leisure time activities of the populace[1].

Leptospirosis is associated with a spectrum of environmental settings and risk exposures. Recreation, travel and water sports have become significant risk factors in industrialized countries[2,3,4], as exemplified by outbreaks during triathlon and adventure tourism events[5,6]. In developing countries situated in tropical climates, leptospirosis is an endemic disease of rural-based populations engaged in subsistence farming, sharecropping and animal husbandry[2,7].

Furthermore, leptospirosis has emerged to become an urban slum health problem in developing countries[8,9]. The rapid expansion of slum settlements, in which 1 billion of the world's population reside[10], has produced the ecological conditions for rodent-borne transmission[8,11].

Epidemics of severe leptospirosis are now reported in cities throughout the developing world[12].

In Brazil alone, more than 10,000 cases of severe leptospirosis are reported each year[12] during outbreaks that occur in major urban cities[8,13,14,15,16]. During these outbreaks, leptospirosis cases cluster in slum settlements which lack adequate sewage systems and refuse collection services[8,13,17].

Public health responses to urban leptospirosis require an improved understanding of the specific exposures in slum communities which lead to epidemic transmission. Urban outbreaks are associated with heavy seasonal rainfall and flooding[8,13,16,18]. Environmental surface waters in slum communities, as found in a study in Peru[11], contain high concentrations of pathogenic *Leptospira* serovars which are associated with acquiring severe disease forms. Leptospirosis is traditionally considered an occupational disease, since work-related activities are frequently identified as risk exposures[1]. However, slum inhabitants reside in close proximity to environmental sources of contamination, such as open sewers, flood areas and trash collections[19]. Determining whether transmission occurs in the household environment will be essential for designing and implementing effective community based interventions none of which are available at present.

In Salvador, a city of 2.4 million inhabitants in Northeast Brazil, outbreaks of leptospirosis occur annually during the seasonal period of heavy rainfall[8,19]. A case-control investigation found that residence in proximity to open sewers and peridomicilary sighting of rats to be the risk factors for acquiring severe leptospirosis[19], suggesting a role for household related environmental exposures in transmission.

Leptospirosis has been reported from Chennai since 1980's[20,21]. The leptospirosis laboratory at the Institute of Microbiology, Madras Medical College was established in 1994[22]. This laboratory receives samples from both government and private hospitals. Data on leptospirosis from government hospitals during the period 2004 – 2006 is given in table 1.

There has been a dramatic increase in the number of leptospirosis cases in the year 2006 during which 2765 cases were reported. The data on leptospirosis from various major public sector hospitals from Chennai city is given in table 2.

**Table 1: Leptospirosis: Annual data of public sector hospitals-Chennai (2004-2006)**

| Year | 2004 | 2005 | 2006 |
|---|---|---|---|
| Leptospirosis | 963 | 1724 | 2765 |

**Table 2: Year 2006 - Government hospital data - Chennai (No - 2765 cases)**

| Hospital | General Hospital | Stanley hospital | Kilpauk MC Hospital | Royapettah Hospital | Children's Hospital |
|---|---|---|---|---|---|
| **Leptospirosis** | **965** | **511** | **563** | **169** | **557** |

All the Chennai city government hospitals reported cases of leptospirosis. Data on leptospirosis in private sector hospitals are not available and therefore the incidence of leptospirosis is under reported.

During the period 1987–91, there were 159 cases of leptospirosis at the General Hospital, Chennai. There were 108 male cases and the mean age was 40.1 years. 136 (85%) had jaundice and 120 (75%) had renal failure. 70 patients were dialyzed and 25 patients died (15.6%)[23].

In the recent past, acute renal failure due to leptospirosis at general hospital Chennai has significantly declined from 31% in 1987 – 91 to 7.5% in 1995-2004[24]. Of the 120 cases of leptospiral ARF during the period 1987-91, the highest numbers of 45 cases were reported in 1990. Since 1992 there has been a decline in leptospiral renal failure cases and during a 10-year period from 1995 -2004 only 84 cases were reported[25].

Though severe leptospirosis has declined, mild leptospirosis has increased. In a collaborative study with Leptospirosis Laboratory, Barbados, of the 57 cases of leptospirosis in 1990-91, Jaundice occurred in 84%, and acute renal failure in 72%. Sero group autumnalis was the most common sero group encountered. 26 patients were dialyzed and 2 patients

died[26]. In a recent study of 106 cases of leptospirosis from north Chennai, Jaundice occurred in 17.8% and renal failure occurred in 10.3% showing a decline in complications. Only two patients were dialyzed and there were no deaths. Fever, headache, myalgia were the common presentations. Contaminated environment (95%) and rainfall (50%) were the important epidemiological risk factors. Icterohaemorrhagiae was the most common serogroup and Autumnalis was not detected[25].

The reasons for the decline in severe leptospirosis suggested were greater awareness of disease, availability of better diagnostic facilities and wide spread use of antibiotics. In addition, serogroup autumnalis, a virulent serogroup causing severe leptospirosis has also declined since 1995. The increase in mild leptospirosis suggest that contaminated environment plays an important role in the persistence and spread of the disease[25].

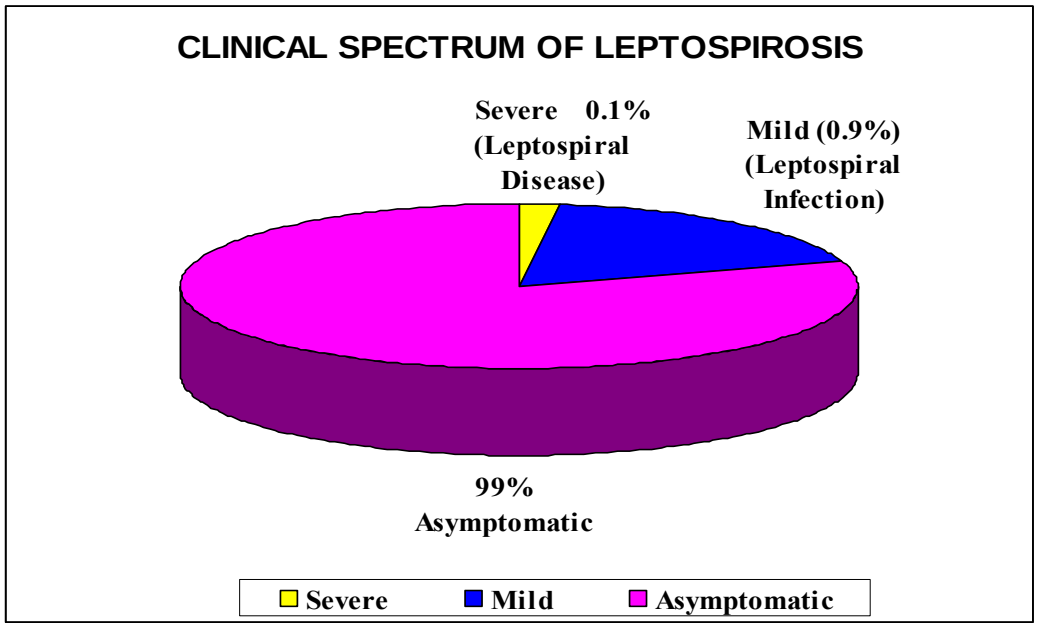
Leptospirosis is an important cause of acute febrile illness. In a recent study of 500 cases of fever at Government Stanley hospital, leptospirosis was the second common cause of fever contributing to 17%, following malaria, which was 27%. Co-infection of leptospirosis (48 cases) with malaria (220 cases) occurred in 22% of cases[27]. Co-infection of Malaria and Leptospirosis has been reported from Chandigarh[28].

A sero survey in Chennai revealed a seroprevalence rate of 32.9% (Range 17.8%- 40.5%)[29]. Uveitis due to leptospirosis has been reported

from Madurai[30]. A majority of 73 cases had panuveitis (95.5%), retinal phlebitis (51.4%) and hypopyon (12.6%).

Most of the leptospiral illness is asymptomatic constituting around 99%. Mild leptospiral illness constitutes 0.9% and severe illness constitutes around 0.1%.

**Clinical spectrum of leptospirosis**




**Incidence**: 10 – 100 / 100,000 populations per year

**Prevalence:** 20 – 50%

## CAUSE FOR THE ASYMPTOMATIC INFECTION

Rodents, the permanent carriers, are considered the major reservoir of infection. Domestic animals, the temporary carriers, such as cattle, dogs, and pigs may act as carriers for several months.

Leptospires are excreted in the urine of the animals and they affect human beings when humans come into contact with the urine of infected animals, directly or indirectly or exposed to an environment contaminated by the urine of the infected animals such as soil and surface water following monsoon rains. Therefore, the illness occurs commonly during monsoon months. The infection is probably transmitted when humans wade through stagnant rainwater contaminated by the infected urine of animals. These organisms survive for six hours in dry soil and for six months in flooded conditions. They enter the host through abrasions of the skin of the feet or intact mucous membranes of eye, throat and gut[31].

Leptospirosis can occur in both urban and rural areas. In urban areas of developing countries, a contaminated environment due to various factors such as over crowded slums, inadequate drainage and sanitation facilities for both man and animals, presence of stray dogs, cattle, pigs, domestic rats, bandicoots, poor condition of slaughter houses and people walking bare foot contribute to the spread of the illness[32,33].

In rural areas, high-risk groups are workers in rice fields, cane fields and other agricultural crops and animal husbandry staff. In addition, the workers in sewers, mines and military personnel are also at risk. It is impossible to trace the source of infection as any person can be infected due to direct contact with animals or contaminated environment.

Therefore, the more important epidemiological factors are rainfall, contact with contaminated environment and animal contact. The number of cases in a region often fluctuates from year to year due to various factors such as rainfall, flooding and animal infection.

## TRANSMISSION TO HUMAN HOST

The transmission of leptospiral infection from animals to man occurs directly by contact with blood, tissues, organs and urine of infected animals or indirectly (more commonly) by exposure to an environment contaminated by leptospires (water and soil contaminated by infected urine). Human to human transmission is rare.

The leptospires enter through cuts and abrasions in the skin or intact mucus membrane such as conjunctiva, vagina, nasopharynx and intestine. The leptospires do not cause local inflammatory reaction.

Transmission of leptospires depends not only on the relationship between animal reservoirs and man, but also on the environment which favours survival of leptospires outside the animal host.

Optimal factors for survival of leptospires are the presence of moisture, warmth (28 – 32$^{o}$C), pH values of soil and surface water (6.2 – 8). Factors which impede survival are salinity, chemical pollution and acidic pH. Flooding after heavy rains is favourable for leptospires and

it can survive for a few hours in dry soil but can survive for six months in flooded conditions[34].

## ENVIRONMENTAL CONTAMINATION

In urban and rural areas of developing countries where leptospires are widespread in the environment and endemic, the infection is related to "the way of life" as well as to the specific occupation. Thus, where there are large numbers of rodents, stray dogs and wild animals, where people drink or bath in untreated water where sewerage and drainage are inadequate, where garbage disposal is inefficient and open shoes or none at all are worn leptospiral infection can be common. This was pointed out by Everard and Everard[32].

**Protecting their head, but feet?**

Fresh water was recognized as an important vehicle for the transmission of leptospiral infections to man. Rat urine contamination of water in wells, sewers, etc., remains an important mode for the transmission of leptospirosis to man. Surface waters into which organisms are excreted may remain infectious for several weeks[1].

In Barbados, 97% of human hospital cases are caused by L. bimo, L. copenhageni and L. arborae, all of which are mainly maintained by rodents on the island. In England and Wales between the year 1985 – 89, the average annual number of confirmed cases was 60, 12/100000 per year. The minimum incidence of severe illness in Dominica between 1989–90 (23/100000) was 192 times higher than that of England and Wales implicating environmental contamination[33].

## OCCUPATIONAL RISK FACTORS

In most areas of the world, leptospirosis is primarily an occupational disease. Agricultural workers have the highest risk of infection, but persons who work in other rodent infested environment are also at risk of infection. Other occupations related to risk are conservancy workers, abattoirs, hunters, fishermen, garbage cleaners, veterinarians and laboratory workers and livestock handlers[34].

The raising of 'wet' land crops such as rice is hazardous as workers often work with their bare feet and hands immersed in water for prolonged

periods of time. The persons involved in raising 'dry' land crops such as sugarcane, vegetables and various grains are also exposed to the risk of infection which is greatest during harvesting.

Major epidemics can occur when seedlings are transplanted into flooded fields by farmers who work for long periods bare footed and bare handed and when crops that are particularly vulnerable to attack by rodents are harvested. Wet soil and heavy early morning dew, mixed with urine voided at night by nocturnal rodents or infected livestock in pastures pose a threat to early morning field workers, particularly in the tropics. Cutting and handling of crops like sugarcane and pineapples frequently cause skin abrasions which may increase possibility of infections.

In one survey in the Caribbean region, it has been found that 45% sugarcane farmers, 33% rice workers, 36% of vegetable and fruit farmers and 20% of animal handlers had been exposed to the disease[31].

Persons who raise livestock may be infected from exposure to their animals urine either directly or indirectly. Infection may also occur from helping an infected animal to give birth or while cutting up infected dead animals.

Leptospirosis is also an occupational disease among workers in poultry, fish processing plants and slaughterhouses. Poultry and fish are not infectious but infestation of processing plants with rodents leads to

contamination of the working area. Rodent infestation of slaughterhouses will also increase the rate of infection.

Miners, conservancy staff (sewer workers, garbage cleaners), construction workers, military personnel, hunters and fishermen are the workers at risk of infection. Veterinarians and laboratory workers are also at risk[34].

A study done by Heath, Alexander and Galton of 483 cases of human leptospirosis reported in United States between 1947 – 60 emphasized the importance of occupation to the risk of acquiring the infection. The probable infecting source was ascertained in 191 cases. 31% involved contact with rats, while 30% were associated with dog exposure, in 20% cattle were implicated as the source of infection[35].

The possible infecting serotype was established by Heath in 409 of 481 cases by serological studies. The commonly encountered serotypes were icterohemorrhagiae – 41%, canicola – 28%, pomona – 20%. Majority of infections due to icterohemorrhagiae could be traced to rat exposure either directly or indirectly through water immersion. Canicola related cases were linked to dog contact, while majority of pomona infections were associated with cattle and swine exposure. In the majority of cases collected by Heath, infection was acquired during the summer and early fall months (63% during June to September).

In another study from Kottayam (Kerala), about 900 cases of fever, jaundice, renal failure over a period of 10 years, the following data were noted. About 50% of patients were in the age group of 29 – 39 years and male/female ratio was 7%. About 74% of the cases occurred during the rainy season from June to November. Disease was commonly seen in agricultural workers, fishermen and oyster shell catchers. Because of heavy rat infestations in many households, even students, officers and housewives were affected by the illness[36].

In a study from Chennai, the maleness, high rainfall and outdoor manual occupation encourage higher incidence rates of leptospirosis. The patients came from various parts of the city and no geographical clustering of cases was evident[32].

The water located in rural areas, developed for recreational purposes provide a habitat for wild life and also are used as a water supply for livestock. Many outbreaks of human leptospirosis acquired by exposure to contaminated water have been described. In 1951, Shaeffee reported 50 cases of pomona infection among a group of 80 young people, which followed a swimming party in a creek located in a pasture for swine and cattle. It is likely that the natural water sources supplying the pool were contaminated by dog or deer or other animal urine[1].

A total of 140 cases of human leptospirosis were reported from 1947–64 in Iowa. Of these, 55 cases occurred in 2 outbreaks in 1959–64 as a result of swimming in water contaminated with leptospires. Galton et al summarized several other recent outbreaks of leptospirosis acquired by swimming in contaminated water sources. Importance of dogs in the transmission of leptospirosis to man was highlighted as a result of an investigation following an outbreak of leptospirosis in St.Louis, Missouri suburb in November 1972[6]. In one study from Hawaii, United States, it was found that 43% of cases were exposed through recreational activities, including fresh water swimming, hiking, camping and hunting[37].

Rainfall is one of the important epidemiological risk factors of spread of leptospirosis. Flooding after heavy tropical rains elevates the water table, allowing saturation of the environment by subsurface leptospires. It prevents animal urine from evaporating or penetrating the soil so that leptospires may pass directly into the surface waters and tops up swampy zones, causing invasion by aquatic rodent or carnivore population from neighbouring cultivated fields. Large outbreaks typically involve a group of people, who have been immersed in floods.

Between November 1979 and the end of December 1986 (7.17 yrs), 248 cases of leptospirosis were confirmed among hospital patients in Barbados (mean age:35) and considering the 235 who were $\geq$15 years of

age, the annual incidence of leptospirosis was 19.2/lakh population. There were 173 males and 62 females. The incidence in areas with rainfall >1800 mm (32.6/lakh) was nearly that in areas without rainfall <1600 mm (17.3/lakh). There is a link between cases of severe disease and recent rainfall. Rainfall is one seasonal factor known to influence the numbers of cases on Barbados as in other parts of the world[38].

Chennai has a land area of 172 $km^2$. The population is estimated to be about 5.3 million. The weather is warm and humid, with an average yearly rainfall of about 1500 mm. Most of the rainfall comes with the North East monsoon (October – December). In Chennai City, between 1979 – 84, there were only 9 cases of leptospirosis in the Government General Hospital, Chennai while between 1987 – 93 there is an increase of cases to 176 cases. Most cases occurred in monsoon months as shown in Table – 3. The infection is probably transmitted to people when they wade through stagnant rainwater contaminated by infected urine of animals. This emphasizes the epidemiological importance of a contaminated environment in the spread of leptospirosis.

**Table: 3 Monthly incidence of leptospirosis (1987 – 1993)**

| January | February | July | September | November | December | Total |
|---|---|---|---|---|---|---|
| 5 | 1 | 1 | 4 | 100 | 65 | 176 |

## SERO SURVEY

Sero survey is an important epidemiological tool for assessing the burden of infection in the community. A sero survey for leptospiral antibodies was made in 1375 persons in Northern Trinidad between the years mid 1977 – 78. Subjects were employees in seven occupational risk groups and three rural and urban communities from general population. High prevalence was found in sugarcane workers – 45%, rural village – 37% and 5% - wood brook, keeping cattle, walking bare foot and hunting was associated with significant leptospiral serology[39].

## ASYMPTOMATAIC INFECTION

We have crowded population living in an environment that favours spread of leptospirosis. It is interesting that we have leptospirosis patients with family members living in the same environment without any leptospirosis manifestation. This study aimed at measuring the magnitude of such asymptomatic infection in the high risk group family members of leptospirosis patients by which we can measure the burden of leptospirosis in our study population.

## DIAGNOSIS OF LEPTOSPIROSIS

Laboratory support is needed:

1. To confirm the diagnosis

2. For epidemiological and public health reasons, to determine which serovar caused the infection, the likely source of infection, potential reservoir and its location.

The tests depend on the phase of infection. During leptospiremic phase (<7 days) leptospires can be isolated by blood culture and PCR, while in the immune phase rising antibodies can be detected by serological tests[31,40].

**Diagnostic Tests**[34]

1. Microscopy
2. Culture
3. Animal inoculation
4. Serology

**1. Microscopy:**

Dark field Microscopy is required to see leptospires in the living state. They can be recognized in clinical specimens such as blood, urine and CSF as spiral organisms. Because of the artifacts confused with leptospires, microscopic examination is not recommended as a diagnostic procedure.

**2. Culture:**

The isolation of Leptospires by culture of blood, CSF and urine is the most definite way of confirming the diagnosis of leptospirosis.

Culture of blood does not contribute to an early diagnosis as results come weeks or even months after inoculation in culture medium.

**PCR** is promising on both sensitivity and specificity, but is complicated and expensive.

**3. Animal Inoculation:**

Isolation may be attempted by inoculating the samples directly into the laboratory animals.

**4. Serology:**

The serological tests for diagnosis of leptospirosis have been classified as serovar specific tests and genus specific tests.

**Serovar specific Tests:**

**Microscopic Agglutination Test (MAT):**

MAT is the gold standard test for diagnosis of leptospirosis because of its unsurpassed diagnostic specificity. The main advantage is that serovars can be identified which is of epidemiological importance[37,40]. The difficulties in utilizing MAT are due to the following factors.

a. The antibody titers rise and peak only in 2nd or 3rd week, making it a less sensitive test.
b. The high titers of past infection persist for a long time (1 – 5 years) and therefore interfere with the diagnosis of current leptospirosis.

Positive titers may represent a rising titer of current infection or declining titer of past infection.

c. The cut off titer for diagnosis of current infection depends on whether the area is endemic or non endemic, for example, the cut off titer varies from 1/80 to 1/400 according to various studies[40]. Therefore, a second sample is usually required (To demonstrate a four fold rise in titer) to diagnose current infection. In endemic area, titer of 1:400 is taken as high titer and in non-endemic areas 1:100 is taken as the diagnostic titer. Sero epidemiological studies are required for determining the cut off value, as a single titer may not be adequate.

d. The test is complicated requiring dark field microscopy and cultures of various live serovars. This may not be available in small laboratories. Figure 3 shows the positive Microscopic Agglutination test (MAT) as seen under the dark ground microscopy.

**Genus Specific Tests:**

The two common tests are the ELISA and Macroscopic Slide Agglutination Test (MSAT). The other tests are latex agglutination test, complement fixation test and haemagglutination tests. The genus specific

tests are the tests of choice for the diagnosis of current infection. These tests are simple, more sensitive and become positive earlier than MAT[41].

These tests detect genus specific antibodies, which are shared by pathogenic and saprophytic leptospira. These tests become positive early in the disease (5- 6$^{th}$ day) as they detect specific IgM antibodies and help in rapid diagnosis of current infection[32].

**ELISA:** This is a popular test and can be performed with commercial kits or with antigen prepared "in house".

**MSAT:** The slide agglutination test is a simple macroscopic test in which a drop of the dense suspension of leptospira is mixed with a drop of serum on a slide and is examined by the naked eye for agglutination. If these tests are positive, they should be confirmed with MAT to identify the serovars. A 2+ agglutination titer is considered significant[41,42,43].

It is noted that, in a study from Brazil by Angelo Brendo et al, SAT seems to be a convenient test for the initial diagnosis of leptospirosis. It detected 65% of the cases of illness with admission sample and 94% with 2$^{nd}$ serum sample collected on about 17$^{th}$ day of symptom whereas, MAT showed only 40% positive rate by 1$^{st}$ sample. This shows that SAT is both sensitive and specific test[41].

In a study from the Institute of Microbiology, Madras Medical College, out of 592 samples received 317 samples were positive by IgM ELISA. Among these, MSAT was positive in 310 (sensitivity 97.8%). 303 samples had MAT titers of >1:80. In all these patients, MSAT was positive. Autumnalis was the most common serogroup (59.9%). 275 samples,which were negative by IgM ELISA, were also negative by MSAT. The MSAT has shown good correlation with both IgM ELISA and MAT[42] (shown in Table 4).

**Table : 4**

| Test Positive | Patients N = 568 | Samples N = 592 |
|---|---|---|
| **IgM ELISA** | **293** | **317** |
| **MSAT** | **286** | **310** |
| **MAT (>1:80)** | **279** | **303** |

Rapid slide Agglutination tests for leptospirosis are well established. Galton et al used 9 cultures and divided them into 3 groups (pooled 3 antigens in each group)[7] and found MSAT to be a sensitive test.

## MANAGEMENT OF SYMPTOMATIC PATIENTS

**Penicillin:** is the most effective antibiotic when given early. In severe illness large doses (6 – 8 million units per day) of benzyl penicillin may be given in divided doses, preferably by IV route, for 5 – 7 days. Fever subsides in 24 to 36 hours.

**Ampicillin:** 1 gm IV q.i.d. in severe illness or 500 – 700 mg q.i.d. in mild illness.

**Cephalosporins:** Cefotaxime 1 g IV b.d. (or) Ceftriaxone 2 g IV o.d.

**Doxycycline:** 200 mg/day, Amoxycillin 500 mg q.i.d.

**Erythromycin:** 250 mg q.i.d. are effective. Quinolones and Cefotaxime are also effective against leptospira.

Antibiotics are very effective only in the early stage (<5 days). Recently there is evidence to suggest that antibiotics are useful even in the late stages of illness.

**Symptomatic and Supportive Treatment:**

The primary important is the meticulous attention to fluid and electrolytes balance to prevent hypovolemia and hypotension. Fever and myalgia can be treated with antipyretics and analgesics.

**Dialysis:**

Peritoneal dialysis is simple, safe and effective procedure for leptospiral acute renal failure. If the peritoneal dialysis is contraindicated hemodialysis can be done.

## PROGNOSIS

Most patients recover. Overall mortality used to be about 15 – 40% and has been reduced to about 5% with better management. Death is usually due to renal failure but it can also occur due to massive bleeding or cardiac and pulmonary complications.

## PREVENTION

Rodent control and other environmental measures to avoid water contamination and water contact prevent the occurrence of Leptospirosis.

Chemoprophylaxis with Doxycycline 200 mg once a week can prevent when a person is exposed to the high-risk environment.

# PATIENTS AND METHODS

Patients aged >12 years admitted with fever suggestive of infectious etiology in medical wards of Stanley Medical College and Hospital, Chennai were investigated with Microscopic Slide Agglutination Test (MSAT) and Microscopic Agglutination Test (MAT) for Leptospirosis.

Leptospirosis was diagnosed by using modified Faine's criteria score of 26 (or) more with MSAT 2+ or above positive patients. Leptospirosis was confirmed using MAT with titer 1:80 (or) above.

Asymptomatic family members who are living with the patients with confirmed leptospirosis were screened for leptospiral infection by using MSAT and MAT. Environmental factors of the living places predisposing leptospirosis were also analysed. The period of this study was from January 2007 to June 2008.

Ethical Committee approval was obtained for this study.

## Criteria for Diagnosis:

Leptospirosis was diagnosed utilizing Modified Faine's Criteria[44] – Clinical (A), Epidemiological (B), Laboratory data (C) (Score >25).

## Diagnosis of leptospirosis - Modified Faine's Criteria

| | | |
|---|---|---|
| **PART A:** | **Clinical Data** | **Score** |
| | Headache | 2 |
| | Fever | 2 |
| | Temp >39° C | 2 |
| | Conjunctival suffusion | 4 |
| | Meningism | 4 |
| | Myalgia | 4 |
| | Conjunctival suffusion<br>Meningism<br>Myalgia | 10 |
| | Jaundice | 1 |
| | Albuminuria / Nitrogen retension | 2 |
| **PART B:** | **Epidemiological factors** | **Score** |
| | Rainfall | 5 |
| | Contact with contaminated Environment | 4 |
| | Animal Contact | 1 |
| | Total | |
| **PART C :** | **Bacteriological Lab findings** | |
| | Isolation of leptospira in Culture – Diagnosis certain | |
| | **Positive Serology** | |
| | ELISA IgM Positive | 15 |
| | SAT - Positive | 15 |
| | MAT-Single positive in high titre | 15 |
| | Rising titre / seroconversion | |

Each feature under clinical, epidemiological and laboratory data were given appropriate scoring.

Diagnosis of leptospirosis is made of if,

Part A (or) Part (A) + (B) with a score of 26 (or) more

Part (A) + (B) + (C) = 25 or more and in serological tests, only one test should be scored.

**Family Members screening**

Asymptomatic family members of the patients were screened with MSAT and MAT.

**Exclusion Criteria**

1. Non-infections causes for fever are excluded.
2. Tuberculosis, malaria, enteric fever, UTI and other infections are excluded.
3. Family members with symptoms suggestive of Leptospirosis are excluded.
4. Family members with H/o symptoms suggestive of leptospirosis within the past six months are excluded from the screening.

The following data were noted:

1. Age, Sex, Occupation and address were noted.
2. Epidemiological profile – H/o rainfall, H/o contact with contaminated environment (Poor sanitation, poor drainage facilities, walking barefoot, recreational activities involving the

contact with contaminated water and bathing in ponds), H/o animal contact (with rodents, dog, cat, pig).

3. Living near river, bathing in river, drinking river water.
4. All the above said factors are noted for the patients and asymptomatic family members of the patients.
5. Clinical features – fever, headache, myalgia, jaundice, oliguria, vomiting, loose stools, altered sensorium, dehydration, hypotension, meningeal signs and hepatosplenomegaly are noted for the patients.
6. Investigations: Hemogram, urine analysis, liver function tests, blood urea, serum creatinine, serum electrolytes, chest x-ray, ECG, Ultrasound abdomen were noted for the patients.
7. MSAT and MAT results were noted for both patients and asymptomatic family members.

## MANAGEMENT

1. Since asymptomatic leptospirosis infection does not require treatment, asymptomatic family members were not treated even their MSAT and MAT results were positive.
2. Mild leptospirosis cases were treated with oral doxycycline

3. Severe leptospirosis (cases with organ dysfunction like renal failure, hepatic dysfunction, aseptic meningitis) were treated with I.V. penicillin (or) cefotaxime.

4. The risk factor (environmental, risk activities) modification is advised for the entire family.

# RESULTS

In this study, 55 patients with leptospirosis were analyzed for their clinical features and environmental risk factors. 107 asymptomatic family members of these patients, who were living in the same environment were also screened for the leptospiral infection. Following are the results.

**Table: 5 Total number of cases**

| Male | Female | Total |
|---|---|---|
| 40 (72.73%) | 15 (27.27%) | 55 |

**Table: 6 Age, sex group distribution**

| Age group | Male | Female | Total | Percentage |
|---|---|---|---|---|
| 13 – 30 | 26 | 7 | 33 | 60.00% |
| 31 – 60 | 12 | 8 | 20 | 36.37% |
| Above 60 | 2 | - | 2 | 3.63% |

Young people were more commonly affected. Mean age was 31.3 yrs.

According to this study, leptospirosis is more common among labourers, most of them being outdoor workers.

**Table : 7 Occupation**

| Occupation | Cases | Percentage (%) |
|---|---|---|
| Agriculture Labourer | 2 | 3.6 |
| Clerk | 2 | 3.6 |
| Driver | 3 | 5.4 |
| Faremer | 4 | 7.2 |
| Fisherman | 1 | 1.8 |
| Housewife | 7 | 12.6 |
| Labourer | 25 | 45.4 |
| Student | 9 | 16.3 |
| Unemployed | 2 | 3.6 |

Large numbers of patients were from Thiruvettriur followed by Thondiarpet, Veyasarpadi and Pulianthope.

**Table: 8 Area wise distribution of cases**

| Areas | Cases | Percentage (%) |
|---|---|---|
| **Basinbridge** | **2** | **3.6** |
| **Ekkaduthangal** | **1** | **1.8** |
| **Ennore** | **1** | **1.8** |
| **GSH staff quarters** | **2** | **3.6** |
| **Kasimedu** | **1** | **1.8** |
| **Kodungayur** | **1** | **1.8** |
| **Korukkupet** | **6** | **10.8** |
| **Manali** | **2** | **3.6** |
| **Mannadi** | **1** | **1.8** |
| **Nethaji Nagar** | **1** | **1.8** |
| **Perambur** | **2** | **3.6** |
| **Periyapalayam** | **1** | **1.8** |
| **Perumalpatti** | **1** | **1.8** |
| **Pulianthope** | **4** | **7.2** |
| **Redhills** | **1** | **1.8** |
| **Royapuram** | **2** | **3.6** |
| **Teynampet** | **1** | **1.8** |
| **Thamaraipakkam** | **1** | **1.8** |
| **Thondiarpet** | **5** | **9.0** |
| **Thiruvallur** | **1** | **1.8** |
| **Thiruvattriyur** | **7** | **12.6** |
| **Thomasmount** | **1** | **1.8** |
| **TVK Nagar** | **2** | **3.6** |
| **Uthukottai** | **1** | **1.8** |
| **Vannarpet** | **1** | **1.8** |
| **Veyasarpadi** | **6** | **10.8** |

More number of cases occurred during rainy season with significant number of cases occurring with rains during summer months also.

**Table: 9 Monthwise distribution of cases (2007-2008)**

| Month | Cases | Percentage (%) |
|---|---|---|
| **January** | **6** | **10.8** |
| **February** | **9** | **16.2** |
| **March** | **5** | **9.0** |
| **April** | **8** | **14.4** |
| **May** | **6** | **10.8** |
| **June** | **1** | **1.8** |
| **July** | **3** | **5.4** |
| **August** | **2** | **3.6** |
| **September** | **6** | **10.8** |
| **October** | **6** | **10.8** |
| **November** | **3** | **5.4** |
| **December** | **0** | **0** |

In this study poor sanitation, inadequate drainage, bare foot walking and rainfall contributed to leptospirosis in most of the cases. Recreational activities and bathing in ponds were not important risk factor in this population.

**Table: 10 Environmental wise distribution of cases**

| Environment | Cases | Percentage(%) |
|---|---|---|
| Poor Sanitation | 26 | 47.2 |
| Inadequate Drainage | 23 | 41.8 |
| Bare foot walking | 42 | 76.3 |
| Rainfall | 34 | 61.8 |
| Recreational act | 5 | 9.0 |
| Bathing in pond | 6 | 10.9 |

Only 20% of the patients presented with fever of less than 5 days duration. Remaining 80% of patients presented with more than 5 days H/o fever. Apart from fever, headache and myalgia were the most common presenting features.

**Table: 11 Duration of Fever**

| Fever | Cases | Percentage (%) |
|---|---|---|
| < 5 days | 11 | 20 |
| > 5 days | 44 | 80 |

**Table: 12 Clinical features - symptoms**

| Symptoms | Cases | Percentage (%) |
|---|---|---|
| Headache | 51 | 92.7 |
| Myalgia | 47 | 85.4 |
| Jaundice | 4 | 7.2 |
| Altered sensorium | 2 | 3.6 |

| | | |
|---|---|---|
| **Conjuntival suffusion** | **4** | **7.2** |
| **Cough / Dyspnoea** | **27** | **49.0** |
| **Vomiting** | **38** | **69.0** |
| **Loose stools** | **13** | **23.6** |
| **Dysuria** | **6** | **10.9** |
| **Past H/o of fever** | **18** | **32.7** |
| **Anaemia** | **26** | **47.2** |
| **Jaundice** | **6** | **10.9** |
| **Pedal Edema** | **6** | **10.9** |

Thrombocytopenia is an important feature of Leptospirosis. In our study, thrombocytopenia was seen in 33 cases (60%). Platelet count less than 50,000 was noted in 2 patients (3.6%). None of them had bleeding manifestation other than rash.

**Table : 13 Platelet count**

| Platelet Count / cumm | Cases | Percentage(%) |
|---|---|---|
| **< 50000** | **2** | **3.6** |
| **50001 – 1 Lakh** | **11** | **20.1** |
| **1 Lakh – 1.5 Lakh** | **20** | **36.3** |
| **< 1.5 Lakh** | **22** | **40** |

Abnormalities in X-ray chest were seen in a small percentage of patients.

In this study, ECG changes were seen in few patients. Most of these changes were due to underlying heart diseases. U wave due to hypokalemia of leptospirosis was seen only in one patient.

**Table: 14 ECG changes**

| ECG | Cases | Percentage (%) |
|---|---|---|
| L V H | 4 | 7.2 |
| T ↓ in Inferior leads | 4 | 7.2 |
| Sinus Tachycardia | 3 | 5.4 |
| U Waves | 1 | 1.8 |
| Bundle Branch Block | 2 | 3.6 |

Leucopenia was seen in one fourth of patients. But majority of patients 34 (61.8%) had normal WBC count.

**Table:15 Total WBC count**

| TC | Cases | Percentage (%) |
|---|---|---|
| < 4,000 | 14 | 25.4 |
| 4,001 – 11,000 | 34 | 61.8 |
| > 11,000 | 7 | 12.8 |

Hepatitis is an expected complication. In liver function test, following results are obtained.

**Table:16 Liver Function Test**

| Test | Cases | Percentage (%) |
|---|---|---|
| Elevated Bilirubin | 5 | 9 |
| Elevated SGOT | 31 | 56.3 |
| Elevated SGPT | 26 | 47.2 |
| Elevated SAP | 8 | 14.5 |
| Low Total protein | 26 | 47.2 |
| Low Sr. Albumin | 14 | 25.4 |

Elevation of SGOT was found in more number of patients than SGPT. This may be due to myositis associated with leptospirosis.

MSAT, which detects genus specific IgM antibodies, is one of the diagnostic tests of acute infection.

The MSAT values are as follows:

**Table:17 MSAT Values**

| MSAT | Cases | Percentage (%) |
|---|---|---|
| 2+ | 51 | 92.8 |
| 3+ | 4 | 7.2 |

As per the MAT – L.gripotyphosa is the most common serotype in this study. Other serotypes were also seen in significant number.

**Table:18 MAT**

| | 1/80 | 1/160 | Total | Percentage (%) |
|---|---|---|---|---|
| australis | 7 | 2 | 9 | 16.3 |
| autumnalis | 2 | 0 | 2 | 3.6 |
| gripotyphosa | 15 | 2 | 17 | 30.8 |
| hebdamidis | 3 | 0 | 3 | 5.4 |
| ictero | 5 | 1 | 6 | 10.8 |
| patak | 8 | 4 | 12 | 21.8 |
| semaranga | 5 | 1 | 6 | 108 |

In USG abdomen, the following results are seen.

**Table:19 USG Abdomen**

| | Cases | Percentage (%) |
|---|---|---|
| **Spleenomegaly** | **11** | **20** |
| **Hepatospleenomegaly** | **1** | **1.8** |
| **Pleural Effusion** | **3** | **5.4** |
| **Ascites** | **2** | **3.6** |

Spleenomegaly is the most common organomegaly in our study. Serositis in the form of pleural effusion and ascites was seen in 9% of patients.

Other Results as follows:

- ⇨ Hypotension in 4 cases (7.2%)
- ⇨ Sinus tachycardia in 16 cases (18.1%)
- ⇨ Low urine output in 9 cases (16.3%)
- ⇨ Meningitis in 5 cases (9%)
- ⇨ High Serum Creatinine in 6 cases (10.8%)
- ⇨ High urea in 7 cases (12.7%)
- ⇨ Hyponatremia in 16 cases (29%)
- ⇨ Hypokalemia in 19 cases (34.5%)
- ⇨ Microcytic hypochromic picture in 24 cases (43.6%)

## Treatment

34 patients (62.2%) were treated with Doxycycline because mild leptospirosis is more common than severe leptospirosis. Parental drugs were needed in 21 patients.

**Table:20**

| Treatment | Cases | Percentage (%) |
|---|---|---|
| **Doxycycline** | **34** | **62.2** |
| **Penicillin** | **2** | **3.6** |
| **Cefotaxime** | **19** | **34.2** |

**Table:21 Modified Faine's Scoring**

| Score | Cases | Percentage (%) |
|---|---|---|
| **< 25** | **1** | **1.8** |
| **25 – 30** | **17** | **30.9** |
| **31 – 35** | **28** | **50.9** |
| **> 35** | **9** | **16.3** |

Environmental risk factors are present in significant number of patients. Due to this, we have modified Faine's criteria score >30 in 28 patients (50.9%)

Animal contact is one of the risk factors. Rodents play a major role. Sighting of rodents was present in and around the residence of 89% of patients.

**Table:22 Animal Contact**

| | Cases | Percentage (%) |
|---|---|---|
| **Dog** | **18** | **32.7** |
| **Cattle** | **5** | **9.0** |
| **Pig** | **3** | **5.4** |
| **Rodents** | **49** | **89.0** |

**Table:23 Water Contact**

| | Cases | Percentage (%) |
|---|---|---|
| **Living near River/Canal** | **10** | **18.1** |
| **Bathing in River** | **4** | **7.2** |
| **Drinking River water** | **2** | **3.6** |

In our study population, water contact in this form does not contribute much to leptospirosis.

**Table: 24 Screening of Family Members**

| Sex | No.of patients | No. of patients with $^{+}$ve family members screening |
|---|---|---|
| **Male** | **40** | **24** |
| **Female** | **15** | **7** |
| **Total** | **55** | **31** |

Of the 55 families, 31 families had atleast one member with Asymptomatic leptospiral infection. This comes to 56.37% of the total families.

Of the 31 families, 24 families belonged to male patients and 7 family belonged to female patients.

**Table:25**

| Sex of patient | No.of patients | Percentage(%) |
|---|---|---|
| **Male** | **24** | **43.63** |
| **Female** | **7** | **12.74** |
| **Total** | **31** | **56.37** |

Total number of family members screened – 107

**Table:26**

| Sex | Number | Percentage(%) |
|---|---|---|
| **Male** | **51** | **47.57** |
| **Female** | **56** | **52.43** |

Number of persons screened in each families varies from one member to five members in each family.

**Table: 27**

| No. of persons screened | 5 members screened | 4 members screened | 3 members screened | 2 members screened | 1 member screened |
|---|---|---|---|---|---|
| **No. of Families** | **1** | **3** | **9** | **21** | **21** |

**Table: 28**

| Sl. No. | Number of persons screened in each family | Number of families | Total number of persons | Number of families with $^{+}$ve results | Number of $^{+}$ve persons |
|---|---|---|---|---|---|
| 1. | 5 | 1 | 5 | Nil | Nil |
| 2. | 4 | 3 | 12 | 1 | 1 |
| 3. | 3 | 9 | 27 | 6 | 13 |
| 4. | 2 | 21 | 42 | 16 | 17 |
| 5. | 1 | 21 | 21 | 8 | 8 |
| 6. | | 55 | 107 | 31 | 39 |

❖ Percentage of positivity among the total members screened

39/107 = 35.6%

**Table: 29 Sex wise distribution of positive persons**

| | | |
|---|---|---|
| Male | 14 | 35.9 |
| Female | 25 | 64.1 |
| Total | 39 | 100 |

**Table: 30 Percentage of positivity in positive families**

| 100% | 66% | 50% | 33% | 25% |
|---|---|---|---|---|
| 12 | 3 | 13 | 2 | 1 |

**Table: 31 Positivity of females among the total females screened**

| Total number of females screened | Females with positive screening test | Percentage(%) |
|---|---|---|
| 56 | 25 | 44.64 |

## Table: 32 Positivity among males

| Total number of Males screened | Males with positive screening test | Percentage (%) |
|---|---|---|
| 51 | 14 | 27.4 |

# DISCUSSION

Leptospirosis is a common disease in parts of urban areas where the environmental conditions are not satisfactory and favour the spread of leptospiral infection. Majority of these leptospiral infections are asymptomatic.

To study the magnitude of the asymptomatic leptospiral infection, this study was undertaken utilizing an index case of clinical, symptomatic leptospirosis admitted in medical wards of our hospital and their asymptomatic family members were screened for leptospiral infection.

In this study, 55 patients were evaluated. 40 of them are males (72.7%), 15 of them are females (27.3%). This indicates maleness is a risk factor for leptospiral disease. This is consistent with a study done in Barbados. 60% of the patients were in the age group of 13 – 30 years with a mean age of 31.3, this age group being the most active period of life having more opportunities of contact with contaminated environment. Labourers were more commonly affected than people of any other occupation. These groups of people are frequently exposed to the contaminated environment.

In over crowded residential areas, where people of poor socio-economic status reside, ineffective solid waste (Garbage) disposal, inadequate drainage facilities leading to water stagnation and wet soil are the important risk factors as they attract rodents and domestic animals.

In our study, inefficient solid waste disposal was present in the environment of 26 patients (47.2%) and inadequate drainage was present in the environment of 23 patients (41.8%).

Barefoot walking is an important risk factor, as leptospirosis enter the host through the abrasions and cuts in the skin. Even walking with slippers does not protect the individual completely and chances of leptospirosis are still there. But wearing shoes can give complete protection while walking through a contaminated environment. In our study, 42 patients (76.3%) are walking with barefoot.

In our study sighting of rodents in and around the living place is an important observation. 49 patients (89%) are having rodents in their environment, especially at the sites of improper garbage disposal.

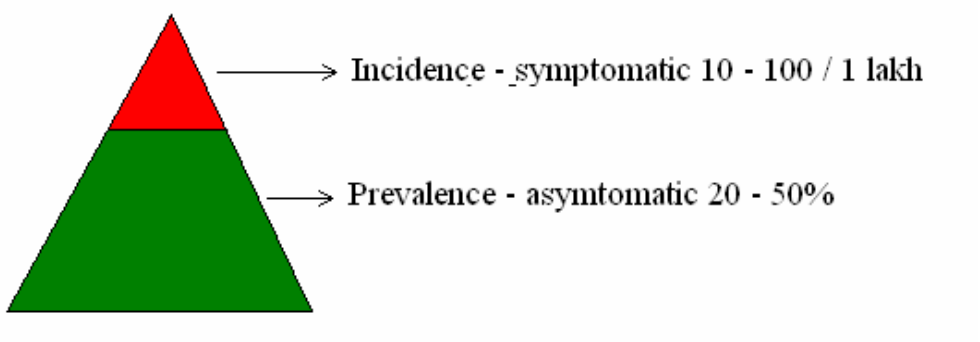
These risk factors are present throughout the year in areas like North Chennai. They are exaggerated during monsoon, making leptospirosis a water borne disease. Also rainfall increases the survival of leptospira in soil. In our study, rainfall is associated with leptospirosis in 34 cases (61.8%). More number of cases occurs during monsoon months.

Interestingly, there was an increase in number of cases during February, March, April and May months of this year. This is due to the unusual rain in February, March and summer rains in April and May. Our study also showed that living near a river, bathing in a river, drinking river water and recreational activities in river waters are not important risk factors for leptospiral infection in our study population (people of North Chennai).

Thiruvottiur, Veyasarpadi, Thondiarpet, Korukkupet, Pulianthope are the areas that contributed to larger number of patients.

In addition to fever, headache and myalgia are the other most common symptoms among our patients. Complications like jaundice (9%), renal failure (10.8% - none of them required dialysis), Hypokalemic paralysis (1.8%), ARDS (1.8%) occur only in a few without any mortality.

It is estimated that incidence of leptospirosis in tropical countries is 10 – 100 / 100000 population/year. At this rate, our country should have one lakh to ten lakhs cases in a year, but we are reporting only 10,000 cases in a year. Prevalence of leptospirosis is 20 – 50%. This will come to around 200 to 500 million.




To find out the magnitude of this asymptomatic leptospiral infection, we considered screening of asymptomatic family members who are living with a symptomatic leptospirosis patients. These persons can be considered to be high risk group, since they are living in the same environment of patient.

In our study, we have 55 symptomatic patients. From the families of these symptomatic patients, a total of 107 asymptomatic persons who resided with them and who did not have febrile illness suggestive of leptospirosis in the past six months were screened.

Of the 107 persons, 56 (52.43%) were females and 51 (47.57%) were males.

31 of the 55 families (56.37%) had atleast one member in each family with a positive result for leptospiral infection. Even though these patients showed a positive result for the test, they cannot be considered to be having leptospiral disease, but an asymptomatic leptospiral infection.

Among the 107 asymptomatic members screened, 39 (36.5%) had a positive screening test.

Index Case - 55 patients
(Symptomatic Leptospirosis)

↓

Asymptomatic Family members screened - 107 members (55 families)

↓

Asymptomatic Leptospirosis - 39 members (31 families)

39 / 107 → 36.5%

A study done in Calicut to estimate the seroprevalence among high risk groups showing 38.1% positivity, similar to our study.

**Table: 33 Calicut Study**

| | |
|---|---|
| **Seroprevalence** | **38.1%** |
| **Fishermen** | **52.8%** |
| **Sanitary Workers** | **56.2%** |
| **Agriculture workers** | **30%** |
| **Sewage workers** | **28.2%** |
| **Healthy Control group** | **24%** |

Our study is also screening the high risk persons living in the same environment.

Another study done in Andaman Islands, which has the highest incidence rate of leptospirosis in the country, showed a seroprevalence of 52.7%.

**Table: 34**

| Occupation | Percentage |
|---|---|
| **Agriculture workers** | **62.5%** |
| **Sewage workers** | **39.4%** |
| **Animal Handlers** | **37.5%** |
| **Butchers** | **30%** |
| **Forest workers** | **27.3%** |
| **Healthy Control group** | **14.7%** |

Another study done in Chennai by Ratnam et al, among conservancy workers (Using MAT) revealed a sero positive prevalence rate of 32.9% (Range 17.8% to 40.5%).

A study similar to our study done in Salvador, Brazil, Hospital surveillance identified 89 confirmed cases of leptospirosis during an out break. Serum samples were obtained from members of 22 households of index cases, 52 control households located in the same community. Antileptospiral agglutinating antibody was used as a marker of previous leptospiral infection. 22 (30%) of the 74 members screened had antibodies whereas 16(8%) of 195 members from control groups showed agglutinating antibodies. This study showed that residing in a household with an index case of leptospirosis was associated with increased risk of having leptospiral infection. Infection was found in all age groups including children.

Our study also screened the high-risk group, the family members who are living with an index case of leptospirosis showed a seroprevalence of 36.5%.

**Probable causes for the asymptomatic infection**

1. Circulation of pathogenic serovars for limited period in specific areas.
2. Exposure to infection during childhood and development of protective antibodies.
3. Host susceptibility varies among individual HLA gene polymorphism have been reported to be associated with the risk of acquiring leptospirosis during an epidemic[45].

It is possible that a person may be exposed to leptospiral infection, in the living place or in the working place or on the way between the living and working place.

In our study, 31 families (56.4%), out of 55 showed positivity, indicating that 56.4% of families having leptospires in their environment.

Most probably patients from these 31 families acquired infection in and around their residence. Remaining 24 patients might have acquired the infection around their working place or on their way.

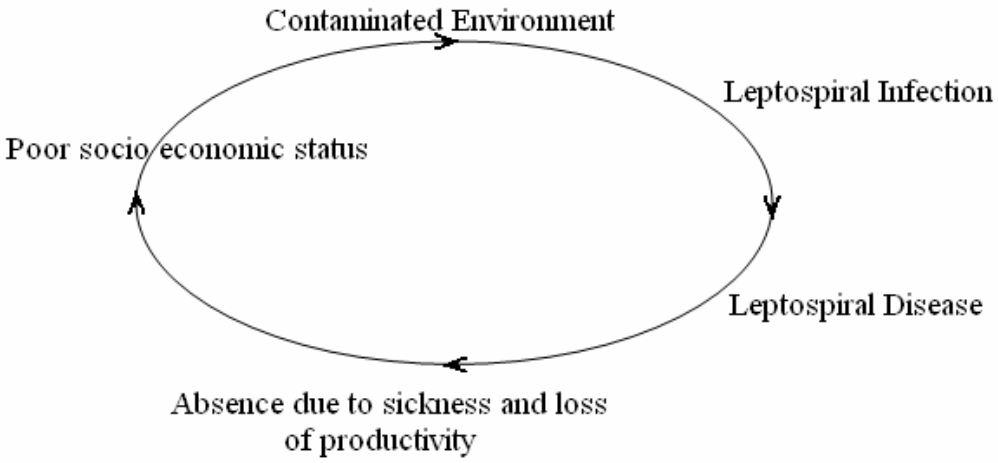
But our study also showed that most of the patients were labourers and most of them working in various parts of North Chennai. This implies that, the overall environmental risk of acquiring leptospiral infection is more for person residing in North Chennai.

We had five members in a family screened for leptospirosis without a positive result. In three families with 4 members (total twelve members) only one person showed positive result out of the twelve. This implies that the total number of people screened in a family did not relate to the positivity among family members.

Everard and Everard pointed out that, where leptospires are widespread in the environment and where the disease is endemic, infection will be related to a way of life as well as specific occupations.

As per our study, risk factors associated with the environment of North Chennai are the most important determinant for leptospiral transmission.

Even though mild leptospirosis (Anicteric leptospirosis) is more common, interventions are necessary to prevent the leptospiral infection. This is because many of the persons affected are from low socio-economic status. Their sickness reduces their productivity and affects the economical development of the family. They will be remaining in a poor socio-economic status, leading to a poor environment around their houses.




**RECOMMENDATIONS FOR ENVIRONMENTAL INTERVENTION**

1. To increase the awareness amongst the people about the risk factors associated with transmission of leptospiral infections.
2. To improve the facilities for proper disposal of solid wastes.
3. To provide adequate drainage facilities and avoid flooding.
4. Rodent control is the most important aspect of leptospirosis prevention.
5. Avoiding barefoot walking will also help to reduce the number of leptospiral infection and hence disease.

If all of these measures are done properly, we can reduce the leptospiral burden of North Chennai.

# SUMMARY

1. Total patients analyzed 55 – 40 males and 15 females with a mean age of 31.3.
2. Labourers are the most common occupation group affected.
3. Environmental risk factors - poor sanitation 47.2%, inadequate drainage facilities 41.8%, barefoot walking 76.3%, presence of rodents in the environment 89%, rainfall 61.8% played major role in leptospiral infection and disease.
4. Anicteric leptospirosis was the most common type – 68.4%, complications seen in 22% patients, without any mortality.
5. All the cases are from North Chennai Veyasarpadi, Thiruvottiur, Tondiarpet, Pulianthope, contribute to large number of cases.
6. Asymptomatic family members of 55 patients were screened. 31 families showed positivity among their members at 56.4%. This indicates 56.4% families in North Chennai having asymptomatic leptospiral infections, while there is a symptomatic leptospirosis in the family, indicating a poor environment around their residence.

7. Among the 107 asymptomatic family members screened, 39 (Male 15, Female 24) showed a positive test for leptospiral infections at 36.5%.

8. Since environment played the most important role in leptospiral infection, interventions to improve the standard of environment, by providing 1) adequate drainage, 2) avoiding flooding, 3) safe disposal of solid waste (Garbage) 4) Rodent control, will definitely reduce the leptospiral infection.

# CONCLUSION

This study identified significant household clustering of leptospirosis among North Chennai people, where the disease is endemic. The finding support the hypothesis that household environment is an important transmission determinant in North Chennai. Prevention, therefore, needs to target sources of contamination and risk activities in the places required.

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**PROFORMA**

| | | | |
|---|---|---|---|
| Name | : | Date of Admission | : |
| Age | : | Date of Discharge | : |
| Sex | : | I.P. No. | : |
| Address | : | | |
| Occupation | : | | |

**Clinical Data**

| | | | |
|---|---|---|---|
| Fever (duration) | : | Cough with expectoration | : |
| Headache | : | Abdominal pain | : |
| Myalgia | : | Altered sensorium | : |
| Jaundice | : | Oliguria, dysuria | : |
| Vomiting | : | Bleeding diathesis | : |
| Diarrhoea | : | | |

**Examination**

Anemia, jaundice, lymphadenopathy, conjunctival suffusion, muscle tenderness, volume status (severity of dehydration)

**Vitals:** Blood Pressure, Pulse Rate, Respiratory Rate, Temperature

**Systemic Examination:**

**CVS :** (Hemodynamic status, evidences for arrythmias)

**RS :** (Evidences for pneumonia)

**ABD :** (Hepatosplenomegaly)

**CNS :** (Meningeal signs)

## Epidemiological Data:

1. Rainfall
2. Contact with contaminated environment. (Poor sanitation, poor drainage facilities, walking barefoot, recreational activities involving the contact with contaminated water and bathing in ponds).
3. H/o animal contact

| Epidemiology | Cases | Percentage (%) |
|---|---|---|
| **I. Rainfall** | | |
| **II. Contact with contaminated environment**<br>**i) Poor sanitation (eg.inefficient garbage disposal)**<br>**ii) Walking barefoot**<br>**iii) Poor drainage facilities (eg.stagnant water)**<br>**iv) Recreational activities involving the contact with contaminated water**<br>**v) Bathing in ponds, lakes and wells** | | |
| **III. Animal contact**<br>**i) Rodents**<br>**ii) <u>Domestic animals</u>**<br>**a. Cattle**<br>**b. Dogs and Cats**<br>**c. Pigs** | | |

## DIAGNOSIS OF LEPTOSPIROSIS-MODIFIED FAINE'S CRITERIA:

| PART A: Clinical Data | Score | Part B: Epidemiological factors | Score |
|---|---|---|---|
| Headache | 2 | Rainfall | 5 |
| Fever | 2 | Contact with contaminated Environment | 4 |
| Temp > 39 C | 2 | Animal Contact | 1 |
| Conjunctival suffusion | 4 | Total | |
| Meningism | 4 | | |
| Myalgia | 4 | | |
| Conjunctival suffusion | | **Part C : Bacteriological Lab findings** | |
| Meningism | 10 | Isolation of leptospira in Culture – | |
| Myalgia | | Diagnosis certain | |
| Jaundice | 1 | **Positive Serology** | |
| Albuminuria / Nitrogen retension | 2 | ELISA IgM Positive | 15 |
| | | SAT - Positive | 15 |
| | | MAT-Single positive in high titre | 15 |
| | | Rising titre / seroconversion (paired sera) | 25 |

Presumptive diagnosis of leptospirosis is made of if,

Part A (or) Part (A) + (B) with a score of 26 (or) more

Part (A) + (B) + (C) = 25 or more and in serological tests only one test should be scored.

## INVESTIGATIONS

Hemogram : Hb, TC, DC, ESR

Platelet count :

Urine analysis : Albumin, sugar, deposits

Renal function test : Blood urea, serum creatinine

Serum Electrolyte : $Na^+$, $K^+$

Liver Function Test: Serum bilirubin (total and direct), SGOT, SGPT, SAP, serum total protein and albumin

Chest X-ray

ECG

Ultrasound abdomen and Pelvis

MSAT (Macroscopic Slide Agglutination Test)

MAT (Microscopic Agglutination Test)

**Diagnosis:** Uncomplicated Leptospirosis / complicated Leptospirosis

**Treatment:**

- Oral Doxycycline / I.V. Penicillin (in severe cases with organ dysfunctions)
- IV fluids, Antipyretics
- Supportive treatment

Asymptomatic family member screening

- Total number of persons screened
- Number of males
- Number of females
- Total number of persons with $^+$ve screening test